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Formation and evolution of the Huangling basement in Yangtze craton, South China

Junqi Wei

Department of Geology, Northwest University, Xi'an, China, Email:weijunqi01@163.com

The North China craton and Yangtze craton are the two largest Archean-bearing blocks in eastern China. They collided along the Qinling-Dabie-Sulu orogenic belt in the Triassic. The Huangling basement (360Km²) represents the only known occurrence of Precambrian basement and Archean rocks exposed in the Yangtze craton, which mainly consists of high-grade metamorphic TTG gneiss, amphibolites, leptynites and khondalite series. It is referred to as the Kongling complex (group). Zircon U-Pb ages and Lu-Hf isotopic compositions from the Kongling complex were analyzed by LA-ICP-MS and LA-MC-ICP-MS. Considered in the context of available geological data, it is suggested that the formation and evolution of Huangling basement can be divided into the following six stages: (1) At >3.2 Ga, there were already old crustal relicts in existence and detrital zircons from the Huangling area show that juvenile crustal additions occurred mainly between 3.2 and 3.8 Ga with a significant peak at 3.3 to 3.5 Ga^[1-3]. (2) At 3.2-3.0 Ga, mafic lava derived from mantle melting erupted and the tholeiitic basalts formed the greenstone belt. (3) At 2.9-2.7 Ga, the greenstone belt was intruded by TTG granitoids (diorite, tonalite, trondhjemite), forming the granite-greenstone terrain and which constituted the Huangling Archean continental nucleus. (4) At 2.6-2.5 Ga the tectono-thermal metamorphic event^[4-5] took place. As a result of this event the TTG granites and tholeiitic basaltic rock were transformed into TTG gneisses and amphibolites, and the Archean granite-greenstone terrain was transformed to the Neoproterozoic stable landmass. In the subsequent 500 million this first stage of cratonization underwent weathering and denudation, with the development of a thick detrital sedimentary cover. (5) At 2.0-1.9 Ga the onset of the second tectono-thermal metamorphic event^[4-5] took place which may be related to the assemblage of the Columbia supercontinent. During this period, the detrital sedimentary sequences were transformed into Khondalite series, associated with the Neoproterozoic stable landmass, so that the Huangling crystalline basement formed in the early Proterozoic. (6) At c. 1.85 Ga, the Huangling basement was intruded by the K-feldspar-rich granite and mafic dikes, which yielded U-Pb zircon ages of 1854 Ma and 1852 Ma. These results indicate that the Yangtze block was transformed into the post-collisional extensional regime at ca. 1850 Ma. By this stage the Yangtze craton had sufficient rigidity to produce large-scale brittle rupture and mantle magmatism, and thus has the characteristics of a craton. Accordingly, we propose that cratonization of the Yangtze craton occurred no later than 1.85 Ga.

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